

**BY ORDER OF THE COMMANDER  
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KIRTLAND AIR FORCE BASE,  
NEW MEXICO 87117-5606**

**KAFB INSTRUCTION 48-105**

**1 JUNE 1997**

**Aerospace Medicine**

**INDOOR AIR QUALITY INVESTIGATIONS**



**COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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This instruction implements AF Policy 48-1, Aerospace Medical Program. It establishes procedures for evaluating, managing, and eliminating factors which may lead to indoor air contaminants. It further defines responsibilities and is applicable to all organizations on Kirtland Air Force Base (KAFB).

**SUMMARY OF REVISIONS**

Contains general administrative updates

**1. GENERAL INFORMATION.**

1.1. Problems with indoor air quality are not new, but it has been only during the past 15 to 20 years that indoor air quality has emerged as one of the most important issues facing environmental health professionals. The use of synthetic building materials and fabrics have become commonplace. New products such as plastics and pressed-wood products were introduced after World War II as materials for building construction and furnishings.

1.2. Relatively simple and less toxic household cleaners such as baking soda, vinegar, soap, and lye solutions have been replaced by more sophisticated chemical formulations. These consumer products are increasingly packaged in convenient aerosol cans which release their contents directly into the indoor air.

1.3. With the ever-increasing efforts toward energy conservation, the desire to reduce heating and cooling costs have led to changes in construction techniques in both commercial and residential buildings which reduced ventilation rates. These changes include tighter building envelopes, fewer and inoperable windows, decreased use of operable windows in older construction, use of sealant foams and vapor barriers, reductions in the amount of outdoor air used for ventilation, improperly sized and

designed heating, ventilating, and air-conditioning (HVAC) systems, renovations of existing buildings without corresponding changes to the HVAC systems, and inadequate building maintenance.

1.3.1. These changes have had two basic effects: an increase in the number and types of contaminants released into the indoor environment and a decrease in the amount of fresh outdoor air that is introduced into structures to dilute contaminants and satisfy the health and comfort needs of the occupants. It is estimated that the availability of fresh outdoor air to dilute indoor air contaminants has dropped from 1.5 air changes per hour to about .5 changes per hour or lower, especially in modern efficient construction.

1.3.2. Increased insulation in buildings and changes in acceptable operating temperatures have resulted in tighter buildings which retain moisture and provide a more favorable environment for microbial growth. Decreases in the amount of outside replacement air led to “stuffy” environments that feel too damp and cold in winter and too warm and stuffy during the summer.

## 2. REFERENCES.

- 2.1. United States Air Force Office of Environmental Health Laboratory (USAFOEHL) Report 87-037EH0253CSI, A Procedural Guide on Sick Building Syndrome
- 2.2. United States Environmental Protection Agency Publication 400/3-91/002, Introduction to Indoor Air Quality
- 2.3. Armstrong Laboratory (AL)-TR-1992-0016, Guide for Indoor Air Quality Surveys

## 3. CONCEPT OF OPERATION.

3.1. The complaints and health effects which might be related to building environments are sometimes similar to those from colds, flu, stress, and other causes. When the reported complaints are non-specific and diverse, it can be difficult initially to determine if problems are caused by the sources or conditions in the building and what can be done to remedy the complaints.

3.2. In some instances, a specific source of contamination or specific building condition causing the complaints is readily obvious. However, in the majority of cases, the investigators must consider all the factors that relate to indoor air quality to identify possible contaminants and stressors which could be responsible for the reported complaints and effects.

3.3. A building investigation is performed in an effort to make these determinations. Because the process of relating symptoms and health effects to stressors and sources is complex, a multilevel team approach is used.

## 4. RESPONSIBILITIES.

4.1. Facility managers will:

4.1.1. Ensure a clean environment is maintained in each working area within their respective facility.

4.1.2. Conduct regular evaluations throughout their facilities to inspect HVAC systems to ensure all ventilation ducts, filters, and conduits are regularly cleaned and initiate proper corrective actions when deficiencies are identified.

- 4.1.3. Review all structural or construction improvement efforts within their facility and implement engineering, substitution, or administrative controls to reduce occupant exposures.
- 4.1.4. Ensure that only safe and approved building materials are used in all renovations, construction, and improvement efforts within their facility.
- 4.1.5. Assist and become part of the indoor air quality investigation team when an investigation is initiated within their facility.
- 4.1.6. Initiate corrective actions recommended by medical personnel following investigation of indoor air quality complaints associated with their facility.
- 4.2. Civil Engineer Squadron (377 CES) will:
  - 4.2.1. Assist and become part of the indoor air quality investigation team when notified.
  - 4.2.2. Survey, evaluate, and complete repairs and maintenance requested by facility managers when implicated as stressors for indoor air quality complaints.
  - 4.2.3. Respond to facility managers' requests for HVAC inspections due to air quality concerns.
- 4.3. Bioenvironmental Engineering (377 AMDS/SGPB) will:
  - 4.3.1. Assist and become part of the indoor air quality investigation team.
  - 4.3.2. Measure indoor air quality parameters such as oxygen levels, temperatures, humidity, carbon monoxide, and any others indicated by the situation or requested by the indoor air investigation team.
  - 4.3.3. Provide recommendations such as engineering, substitution, or administrative controls that will help reduce or eliminate identified indoor air quality stressors.
- 4.4. Public Health Flight (377 AMDS/SGPM) will:
  - 4.4.1. Assist and become part of the indoor air quality investigation team.
  - 4.4.2. Conduct epidemiological surveys as determined by the investigative team; evaluate and tabulate data; and coordinate findings with SGPM and the chief of Occupational Medicine.
  - 4.4.3. Conduct follow-up surveys, as needed, to determine extent of corrective actions taken.
- 4.5. The chief of Occupational Medicine (377 AMDS/SGPFO) will:
  - 4.5.1. Assist and become part of the indoor air quality investigation team.
  - 4.5.2. Assist in interpreting occupant survey and investigation findings.
  - 4.5.3. Perform medical histories and physical examinations to further define illnesses related to indoor air quality versus other causes when deemed necessary.
  - 4.5.4. Provide medical expertise and education to building occupants as needed to dispel concerns and questions related to indoor air quality.

## 5. PROCEDURES.

- 5.1. Individuals with health complaints associated with their work environment will report their concerns to their facility manager for individualized corrective actions. Facility managers will report accumulative reports of health complaints or concerns from building occupants to SGPM.

- 5.2. Complaints will be discussed to determine if worksite surveys and investigation are required.
- 5.3. A facility investigation will be conducted using a team approach with the team composed of representatives from SGPM, SGPB, SGPFO, 377 CES, along with the facility manager. The survey team will in-brief the facility commanders, supervisors, and maintenance engineers.
- 5.4. The team will determine any stressors as possible contaminant sources for the indoor air quality complaint (HVAC, renovations, new furnishings, etc.). If deemed appropriate, SGPM will distribute occupant surveys at the time of initial worksite evaluation.
- 5.5. If deemed appropriate by the team, SGPB will conduct air sampling for possible airborne contaminants.
- 5.6. If occupant surveys are conducted SGPM will compile occupant survey data and determine possible relationships with information obtained during the site survey evaluation. The results of the survey data will be provided and reviewed with SGPB and SGPFO for recommended corrective actions.
- 5.7. The survey team will out-brief commanders, supervisors, and facility managers and present the final report along with recommendations for corrective actions.
- 5.8. A follow-up evaluation will be conducted by the SGPM 3-6 months after completion of recommended corrective actions. If deemed appropriate by the investigation team, occupant surveys will again be distributed to building occupants, tabulated, and results provided to determine if additional evaluations, employee exams, or corrective actions necessary.

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**Attachment 1****INDOOR AIR QUALITY GUIDE FOR FACILITY MANAGERS/SUPERVISORS**

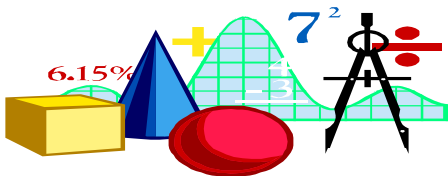
A healthy indoor environment is one in which the surroundings contribute to productivity, comfort and a sense of health and well being. The indoor air is free from significant levels of odors, dust and contaminants and circulates to prevent stuffiness without creating drafts. Temperature and humidity are appropriate to the clothing and activity of the building occupants. There is enough light to illuminate work surfaces without creating glare, and noise levels do not interfere with activities. Sanitation, drinking water, and other factors effecting health and safety are well planned and properly managed.

The definition of good indoor air quality includes:

- Introduction and distribution of adequate ventilation air.
- J Control of airborne contaminants.
- Maintenance of acceptable temperature and relative humidity.

Good air quality is an important component of a healthy indoor environment!

A practical guide to indoor air quality (IAQ) cannot overlook the temperature and humidity factors, because thermal comfort concerns underlie many complaints about “poor air quality.” Furthermore, temperature and humidity are among the many factors that effect indoor contaminant levels. It is important to remember that while occupant complaints may be related to time at work, they may not necessarily be due to the quality of air. Other factors such as noise, lighting, ergonomic stressors (work station and task design), and job related psychological stressors can (individually or in combination) contribute to the complaints.



Failure to respond promptly and effectively to IAQ problems can have consequences such as:

- Increasing health problems such as cough, eye irritation, headaches, and allergic reactions, and in some rare cases, resulting in life threatening conditions (such as carbon monoxide poisoning or Legionnaire's disease).
- Reducing productivity due to discomfort or increasing employee absenteeism.
- Accelerating deterioration of furnishings and equipment.
- Straining relations between tenants, employers and employees.
- Opening liability problems due to insurance policies' tendency to exclude pollution-related claims.



Provision of good air quality requires conscientious effort by both building staff and occupants. The commitment to address IAQ problems starts with the building owner or facility manager, the person who has an overview of the organization, sets policy, and assigns staff responsibilities. You have the authority to see that an IAQ policy is articulated and carried out; the ability to identify staff with skills that enable them to react promptly and effectively to complaints; and the incentive to initiate a program that will prevent indoor air problems in the future. As you decide how best to respond to the challenge of preventing and resolving indoor air quality issues in your building, it will be helpful to keep in mind the following thoughts:

It is important to establish a process that encourages an active exchange of information.

Without an open communications policy, an atmosphere of distrust may be created that complicates your efforts to diagnose and correct problems.

Facility staff members are in a position to notice malfunctioning equipment or accidental events that could produce indoor air quality problems.

They can play a critical role in identifying problem situations and averting IAQ crises. On the other hand, if staff members are not aware of IAQ issues, their activities can also create indoor air quality problems.

Facility staff members are often instructed to keep energy costs to a minimum.

Changes in building operation intended to save energy have sometimes contributed to IAQ problems (for example, by reducing the flow of outdoor ventilation air without taking action to maintain the quality of the recirculated air). The correction of IAQ problems has sometimes led to reduced energy use due to the efficiency associated with a cleaner and better controlled heating, ventilation, and air conditioning (HVAC) system. The energy needed to condition and distribute ventilation air is only a small part of total building energy consumption and is overshadowed by other operating costs. Attempting to limit operating costs by reducing ventilation can be false economy if it leads to problems such as increased occupant complaints, reduced productivity, and also absenteeism.

An indoor air quality problem may be the direct or indirect result of an apparently minor modification.

Actions such as the placement of interior room dividers, acquiring new office equipment, and personal activities such as cooking can have an impact on indoor air quality. Communication between building occupants and building management concerning their mutual responsibilities is a critical element in the management of indoor air quality.



Indoor air quality in a large building is the product of many influences, and attempts to bring problems under control do not always produce the expected results.

Some indoor air quality problems are complex and may require the assistance of outside professionals. When contracting for services, you need to be an informed client to avoid unnecessary costs and delays in solving the problem.

If there is a reason to believe that an IAQ problem may have serious health implications, Public Health (846-3461) and Bioenvironmental Engineering (846-4259) should be called in as soon as possible.

Every complaint merits a response.

Many indoor air quality problems are not difficult to correct and can be solved with in-house expertise. However, gathering congruent information about the problem and identifying appropriate corrective actions are likely to require a coordinated effort by people with a variety of skills.

Be prepared to answer the following:

- What is the problem?
- Where is the problem?
- Who is effected?
- When does the problem occur?

Note that the development of health effects on an individual who is exposed to chemical, physical, and biological stressors depends on factors including genetics, sex, personal habits, diet, age, and health status.

After a telephone interview, it will be determined if an investigation of the building is necessary. The inspection will start with the administrative of a health effects questionnaire. Results will be analyzed and a building evaluation will usually be accomplished. If characterization of contaminants is needed sampling may be performed. Final evaluation and analysis is then accomplished to generate a report outlining apparent causes of reported symptoms and recommended corrective actions.

Questions on IAQ may be directed to Public Health Flight at 846-3461.

SELECTED INDOOR AIR QUALITY PROBLEMS	This box is provided to help building owners and facility managers get acquainted with examples of IAQ problem indicators and associated responses. Some IAQ problem situations require immediate action. Other problems are less urgent, but all merit a response.
Problems Requiring Immediate Action	<ul style="list-style-type: none"> <li>• There have been complaints of headaches, nausea, and combustion odors. Carbon monoxide poisoning is a possibility. Investigate sources of combustion gases right away.<sup>2</sup></li> <li>• One or more occupants of your building have been diagnosed as having Legionnaire's Disease. This is a potentially life-threatening illness. Request Health Department assistance in determining whether your building may be the source of the infection.</li> <li>• Staff reports that water from a roof leak has flooded a portion of the carpeting. If damp carpeting cannot be lifted and thoroughly dried within a short time, it might need to be discarded. Proper cleaning and disinfecting procedures must be used to prevent the growth of mold and mildew that could cause serious indoor air quality problems.</li> </ul>
Problems That Require a Response, But Are Not Emergencies	<ul style="list-style-type: none"> <li>• Inspection of the humidification system reveals an accumulation of slime and mold. There have been no health complaints suggesting IAQ problems. Inadequately maintained humidifiers can promote the growth of biological contaminants. Clean equipment thoroughly and consider modifying maintenance practices.</li> <li>• A group of occupants has discovered that they share common symptoms of headaches, eye irritation, and respiratory complaints. The symptoms described suggest an IAQ problem that is not life-threatening, but it would be wise to respond promptly.</li> <li>• Immediately after delivery of new furnishings (furniture or carpeting), occupants complain of odors and discomfort. Volatile compounds emitted by the new furnishings could be causing the complaints.</li> </ul>